CLARK COUNTY VOLUNTEER MONITORING PROGRAM

Lake-Sampling Instructions

Welcome to Clark County's Volunteer Monitoring Program. We are excited to get you involved! Our program relies on volunteers working directly in a county monitoring program, as well as on citizens working independently, with interest in specific issues or regions within the county. Regardless of where one chooses to monitor this manual provides a means to get to the desired endpoint: credible, meaningful data that can be used by agencies and resource managers to guide resource decisions.

The **procedures** of this manual include measures of physical and chemical make-up, and biological integrity of lakes. Volunteers have access to an array of procedures, ranging from high tech monitoring equipment to visual assessments of algae and aquatic plant growth.

The **Clark County Volunteer Monitoring Program's ambition** is to set in motion the activities of citizens interested in examining the health of Clark County's water resources. We can educate, equip, and escort volunteers while promoting stewardship of water and watersheds. Most importantly we want you to enjoy yourself, have fun outdoors, and learn, learn, learn…

The Clark County Volunteer Monitoring Program is run jointly by Clark County Public Works Water Resources and the WSU Cooperative Extension, Watershed Stewards, with funding provided by the Clark County Clean Water Program and a Washington Department of Ecology grant.

CLARK COUNTY DEPARTMENT OF PUBLIC WORKS

WATERSHED STEWARDS OF CLARK COUNTY, WSU COOPERATIVE

ECOLOGY WATER QUALITY PROGRAM

Background

This document summarizes the general activities of volunteer monitors in their **lake** monitoring efforts. It provides information regarding the use of sampling equipment and the collection of water samples and field data. Volunteers are encouraged to read through this document to get a general understanding of the routine, and also use it as a reference to address specific questions or concerns. Following this standardized monitoring approach in all data collection efforts helps Water Resources staff compare data from different sampling events. Summarizing data in reports and newsletters for the public is a primary goal of the program.

Goals

Volunteer collected lake data is used for a variety of purposes in the county's water resources program:

- developing data records for water resources
- describing current lake conditions in terms of lake health
- estimating seasonal and spatial variability in lake conditions
- screening for potential problems or areas needing further study
- educating and promoting stewardship of valuable water resources

Volunteer monitoring methods focus on a concept of "lake condition", or the current health of a lake. Accelerated eutrophication, the term used to describe the rapid aging of a lake, is the primary concern of scientists, resource managers, and lake users. Eutrophication can be accelerated when pollution enters a lake from disturbances in the watershed, or the area that drains into the lake. General symptoms of eutrophication include increased algal growth from nutrient enrichment, increased rooted aquatic plant growth from nutrient and sediment enrichment, and lower dissolved oxygen concentrations in all or parts of the lake from the decomposition of plant matter. Each of these symptoms can limit the use of the lake by humans and by wildlife.

Volunteers monitor a set of parameters that characterize each of these symptoms or conditions:

Table 1. Indicators of lake condition.

Condition	Monitoring Parameter	Technique
Algae	Water clarity	Secchi disk
Algae	Density and type	Visual observation
Algae	Nutrients	Total phosphorus
Aquatic Plants	Distribution and type	Visual observation
Dissolved Oxygen	Oxygen and water temperature	Depth profile

In addition to these core parameters, volunteers may also collect water samples for chlorophyll *a*, bacteria, and turbidity as indicators of lake condition. Arrangements need to be made, however, to have samples analyzed either at a professional lab or by the volunteers.

Field Procedures

Preparation

Contact the county volunteer coordinator

Contact Water Resources staff to ensure all arrangements for sampling are made. Arrangements may include access to the waterbody via private land, information about the sampling schedule or the parameter list, information about the lake and sampling locations, preparations for getting equipment, arrangements to get water samples to appropriate labs or staff, instructions for data management, and boating requirements.

Prepare the equipment

Lake-sampling Equipment

- ✓ Secchi disk and rope
- ✓ Water sampler w/ messenger
- ✓ Sample bottles and cooler
- ✓ YSI DO/Temp meter
- ✓ YSI pH meter
- ✓ Weighted sounding line
- ✓ Field notebook and data sheets
- ✓ Boat equipment
- ✓ Life vests
- ✓ GPS
- ✓ Area maps
- ✓ Methods manual

When you get the sampling kit, inspect the equipment to make sure it is in proper working order. Test the power supply on sampling instruments and calibrate them if necessary (see individual parameter methods below). Label the water sample bottles if necessary with the site name (e.g. lake name) and sample locations, and dates (time will be entered later).

Before leaving the shore make sure the boat/canoe has appropriate safety equipment. Volunteers must confirm that all needed safety equipment is on board. Safety is a priority over all other objectives of sampling trips. Volunteer should always wear a life preserver and be aware of dangers in each working environment.

In the field

Record your site data

If an established sample site exists, locate it via maps or landmarks. If there are no existing sites, an appropriate location must be found. Samples are typically collected from the deepest portion of a lake. Local users of the lake, such as boaters and fisherman found at boat ramps or tackle shops may have knowledge of the lake bottom. Estimate the depth at several locations with a weighted rope or depth finder if one is available. Once at the site, anchor the boat to prevent from drifting.

Once a site is located record the position in the lake with the Garmin handheld GPS or via landmarks. Use the "Quick-star" guide in the field kit to record latitude and longitude. Fill-in the upper portion of the "Lake Field Data sheet" including the lake and station name, the date, the time of sampling, and the names of the field crew. Record weather observations and any other comments on lake conditions observed at the site that may affect sampling results. Record the estimated total depth of the water using the weighted sounding line.

Measure the Secchi disk depth

The Secchi disk is used to measure how deep a person can see into the water. In very clear lakes, disk readings greater than 30 feet can be measured. On the other hand, lakes affected by large amounts of algal growth or sediments often have readings less 1-2 feet. Factors attributable to sampling methodology that may affect a Secchi disk reading include the observer's eyesight, the angle of the sun (time of day and season), weather conditions (clouds, rain), or waves and surface glare. Volunteers must take note of these factors to limit their influence on the reading.

Steps

1. Work on the shady side of the boat to eliminate glare.
2. Remove sunglasses before taking the measurement.
3. The Secchi disk line is marked in 1-meter increments. Lower the disk into the water, keeping your back toward the sun to block glare, until it is no longer visible.
4. Place a finger on the line at the water's surface to mark that point.
5. Raise the disk until it becomes visible again. Mark this spot on the line with your other hand.
6. Record the midpoint between these two measurements as the Secchi depth, estimating your value to the nearest quarter-meter.

Note: This procedure can be repeated as a quality control check; an average of the two readings should be recorded on the sampling form.

Observe algae and aquatic plants

Visual observations of algae and plants are helpful to analyzing the data collected during sampling. Volunteers should record the approximate amount or density of algae and plants seen at 1) the areas around the shoreline or launch point and 2) at the sampling site. The following guidelines from the King County Volunteer Training Manual for lakes can be used to make observations of algae and plant density and distribution.

Steps:

1. For algae lower the Secchi disk into the water to a depth of about 2 feet.
2. Using the white portions of the disk, classify the condition of algae according to an element in the chart below. Use C1-C3 if the algae appears cloudy and P1-P3 if larger particles can be discerned. Record the rating in the comment section of the Lake Field Data sheet.

Rating	Description
NA	Clear water; no visible algae, either cloudy or particulate.
C1	Very faint cloudiness.
C2	Moderate cloudiness.
C3	Very cloudy, murky water.
P1	A few algae particles or colonies visible (1-10 particles).
P2	Moderately dense with particles (10-100).
P3	Dense algae particles – bloom conditions (>100 particles).

Note: This table and method are adopted from the King County Volunteer Lake Training Manual.

1. For plants use the following categories to estimate the density of floating and rooted aquatic plants around the shoreline and at the sampling site. Use F1-F3 for floating-leafed aquatic plants (water lilies, hyacinth) and S1-S3 for submersed aquatic plants (millfoil, pondweed). Record emergent cattails or rushes if present.

Rating	Descriptions
NP	No visible aquatic plants.
F1 or S1	Light plant growth on the lake surface or bottom.
F2 or S2	Medium plant growth on the lake surface or bottom.
F3 or S3	Heavy plant growth on the lake surface or bottom.

Note: This table and method are adopted from the King County Volunteer Lake Training Manual.

Perform dissolved oxygen and temperature profile

Oxygen is vital to life in lakes. Its sources include diffusion of atmospheric oxygen into the water and production of oxygen through photosynthesis by plants and algae. Vertical mixing of water is very important to distributing oxygen to all parts of a lake. Winds and temperature changes during seasonal shifts aid vertical mixing. Water temperature affects the capacity of water to retain dissolved oxygen as cold water can hold more oxygen than warm water. Oxygen is consumed in water by respiring organisms such as algae, plants, bacteria, zooplankton, and fish. Oxygen also diffuses back into the atmosphere near the surface of a lake.

Oxygen depletion in all or parts of a lake is an indicator of lake condition. Bacteria decompose plant and animal matter that has settled through the water column and subsequently consume enormous amounts of oxygen in these deeper lake-layers. Cut off from the supply of oxygen in the upper layers of the lake, the deeper regions become oxygen poor environments. This can severely limit habitat availability for certain groups of organisms, especially fish.

Volunteers characterize the dissolved oxygen condition in lakes by measuring oxygen and water temperature from the surface to the sediments using a meter.

Steps:

1. Turn on the YSI DO/temperature meter and allow the meter to warm up for at least 15 minutes.
2. The instrument will activate all segments of the display for a few seconds, then go through a self-test procedure that will last a few more seconds. A number will be displayed along with the letters “cel”. That number should be between 4.8 and 5.2. If not, report the number on the data sheet and to the office staff.
3. If the unit displays “Err” at this point, try turning the unit off and back on again. If it displays “LO BAT,” replace the batteries and discard the old ones. If it displays other error messages, you will not be able to use the instrument—record the

problem and let the staff know about it as soon as possible. If it displays number readings, "rcl," or "ErAS," the meter is functioning properly.

4. Remove the probe from the calibration chamber on the side of the meter. Shake any water off of it as you would shake down a mercury thermometer. If the sponge inside looks dry, add a few drops of water, let it soak in, and then pour off the excess. Examine the probe. All holes should be clean of debris, and the gold cathode on the end should be shiny. The plastic membrane over the cathode should not be loose, wrinkled, damaged, or dirty, and there should be no bubbles larger than 1/8" under the membrane. Rinse if needed with purified water. If problems persist, note these on your data sheet and continue as best you can with the procedure. Replace the probe in the calibration chamber, inserting it all the way.

(Note: The YSI 85's buttons are slow to respond, so wait a few seconds after pressing any button to give the meter time to react. Otherwise, you may skip over the screen you want…)

5. Calibrate the meter:

(NOTE: Keep the meter in the shade while calibrating.)

- After the meter has been on with the probe inside for 15-20 minutes, get to a screen that shows a figure in % near the top. (Press the MODE button repeatedly if you need to change screens, leaving a second or two after each pressing). This is the DO (dissolved oxygen) % saturation screen.
- Press both UP and DOWN ARROW buttons at the same time. The next screen will prompt you to enter the altitude to the nearest hundreds of feet, using the UP or DOWN buttons to change the number. For instance, 2 would mean 200' elevation. (If you don't know your exact altitude, take your best guess and record your guess on the data sheet. Most downstream reaches are near sea level.) Set the proper elevation, then press ENTER once.
- The meter will now show CAL in the lower left of the display. Make sure the % reading stays within a range of one full % for 30 seconds, then press ENTER once. The display should read "SAVE," and the instrument is now calibrated for DO.
- The temperature probe needs no calibration. The conductance probe is calibrated at the office, and the latest calibration date should be written on a sticker on the back of the meter. Record that date on your data sheet.

6. ***Record the time*** on your data sheet, to the nearest minute.
7. Lower the electrode to the desired sampling depth, stirring the water around the sensor by gently bouncing the electrode with the cable; allow it to stabilize (should take approximately 1-2 minutes). Have the screen on the meter set to DO mg/L.
8. Record the water temperature and dissolved oxygen level at that depth.

9. Continue this procedure until all depths in the profile have been measured.
10. A typical profile starts a few feet off the bottom of the lake and continues systematically toward the surface. If a lake is fairly shallow, readings can be taken every foot. In deeper lakes, readings should be taken at a more appropriate scale to characterize the water column. Ten to fifteen readings are often appropriate.
11. ***Turn off the meter***.

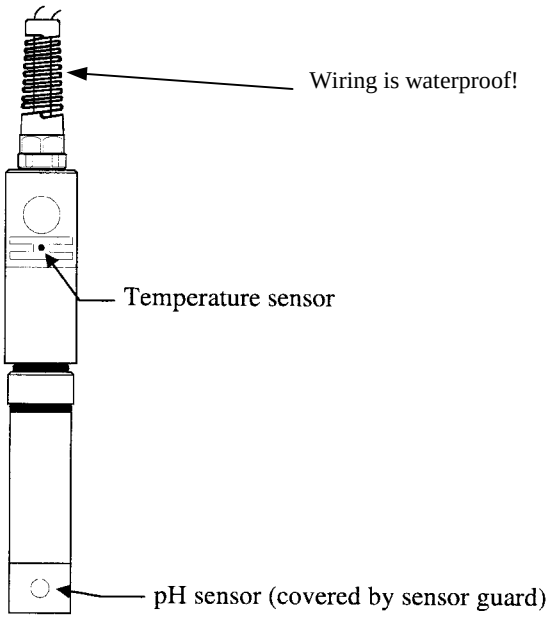
Perform pH profile

The pH of water has an important influence on chemical reactions and chemical availability. pH often changes with rapid algal growth, increasing to levels higher than the neutral level of about 7. Conversely, effects of pollution from the atmosphere known as acid deposition or acid rain can lower the pH of the water.

(Note: County staff will calibrate the pH meter prior to checkout. The program may require occasional checking of calibration with a pH buffer.)

Steps:

1. Turn on the YSI-60 pH meter to start its 15-minute warm up. All segments of the display will be activated for a few seconds. Eventually, pH and temperature will be displayed. If "LO BAT" is displayed then you will need to replace the batteries. If pH and temperature are not displayed, press "MODE" until you get to the right display on the screen.
2. Set the meter down in a shady spot during this warm-up period.
3. After the YSI-60 pH meter has warmed up for at least 15 minutes, get a screen that shows pH and temperature. You may need to press **"MODE"** repeatedly until this screen appears.
4. Remove the probe from the transport chamber of the meter and lower the probe in the water to the desired depth. **Make sure the pH sensor at the end of the probe and the temperature sensor near the top of the probe are both immersed** in the water.



5. Allow enough time for the meter readings to stabilize. It may take several minutes. Take your reading when the meter stays within a range of 0.1 pH unit (plus or minus 0.05 pH units) for 30 seconds. Then record pH to the nearest 0.1 pH unit.
6. Shake off the probe and inspect it for dirt, and insert it back into the transport chamber so that the pH sensor won't dry out.
7. **Turn off the meter**.

Collect water samples

Water samples can be collected from different lake depths for a variety of chemical or biological analyses including total phosphorus, chlorophyll a, bacteria, turbidity, or algae and zooplankton. Certain analyses have stringent sample container requirements that must be followed, such container type or size, or whether or not to rinse the container. Volunteers should contact the project coordinator or laboratory staff prior to sampling to get appropriate bottles and preservatives, and sampling instructions.

EPA's volunteer monitoring guidance describes two procedures for collecting water samples at discrete points below the water's surface. Volunteers should use the method that suits the monitoring objective and equipment availability. Often times a single sample collected just below the surface, at about the 1-m level is required. In addition, samples collected near the lake bottom where chemicals accumulate are of interest.

If volunteers are collecting samples for bacteria analysis, the sampling location may differ from that used for most other sampling. While most sampling occurs over the deepest area of the lake, bacteria samples are often collected at swimming beach areas,

where the risk of human exposure to waterborne disease is greatest. Samples for bacteria analysis should be collected in water three to four feet deep.

Procedure A: Elements of hand sampling just below the surface.

1. Remove the cap from the sampling container, taking care not to touch the container mouth.
2. Rinse the container with lake water by holding it by the bottom and plunging it mouth-first into the lake to about elbow depth. Your hand should always move in a forward motion so that water will not slide over it into the bottle. Fill the container, turn the mouth upwards, bring it above the surface, and empty the container as a rinse. Rinse the container cap as well.
3. Using the same motion, collect the sample of water in the container capping tightly.
4. Store the container in the ice cooler away from the light.

Procedure B: Elements of point sampling using a water sampler

1. Check to make sure that the water sampler is securely attached to the measured line.
2. Open the sampler's cups and secure the cables on the trigger assembly.
3. Lower the sampler gently into the water to the desired depth using the line marked in feet.
4. Slide the messenger down the line to close the stoppers.
5. Gently haul the sampler to the surface, then release some of the sample water into the appropriate sample container. Swirl it in the container to rinse and then pour it out. Rinse the container cap in the same manner.
6. Release sample water into the container until it is almost full, leaving some air space at the top and capping it tightly.
7. Store the container in the ice cooler away from the light.

Wrap-up

Before leaving the sample site ensure all sample bottles have been filled and that the datasheet is completely filled out. Designate a member of the field team to track the samples and the datasheets back to the coordinator or to the lab. Clean out the sampling equipment and properly store it before returning it to the coordinator or using it for the next sampling trip. Be sure to notify the coordinator of any problems with the sampling equipment.

Quality Assurance Steps

- Quality data starts with quality sampling methods.
- Volunteers should follow the procedures in this document as closely as possible in the field. Deviations from the protocols should be noted on the field data sheets.

- Training is an essential part of quality data collection and proper performance of field methods. Volunteers should be initially trained and offered ongoing training during the life of the project.
- Try to sample as near mid day as possible.
- Use an anchor to prevent drifting while sampling.
- If no depth has been specified for sampling, sample at 1 meter, or three feet.
- Rinse sampling devices prior to collecting samples.
- Hold sample containers and sampling devices by the edges or handles to avoid contamination.
- Store samples in an ice chest or refrigerator until submitted to the lab.
- Volunteers should fill out data sheets completely and verify entries before leaving the site.
- Check all datasheets and sample bottle labels to ensure they have the correct date and site ID.
- Ask questions of your volunteer coordinator or project sponsor.

Additional references:

EPA volunteer monitoring program and guidelines:
http://www.epa.gov/owow/monitoring/lakevm.html

Washington Department of Ecology's A citizen's guide to understanding and monitoring lakes and streams:
http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/index.html

Washington Lake Protection Association: http://www.nalms.org/walpa/

The Great North American Secchi Dip-in: http://dipin.kent.edu/